

# VANADIUM ENERGY STORAGE SYSTEMS (VESS)



## PINNACLE VRB LTD

### Renewable & Remote Area Power Applications

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# VANADIUM ENERGY STORAGE SYSTEMS (VESS)



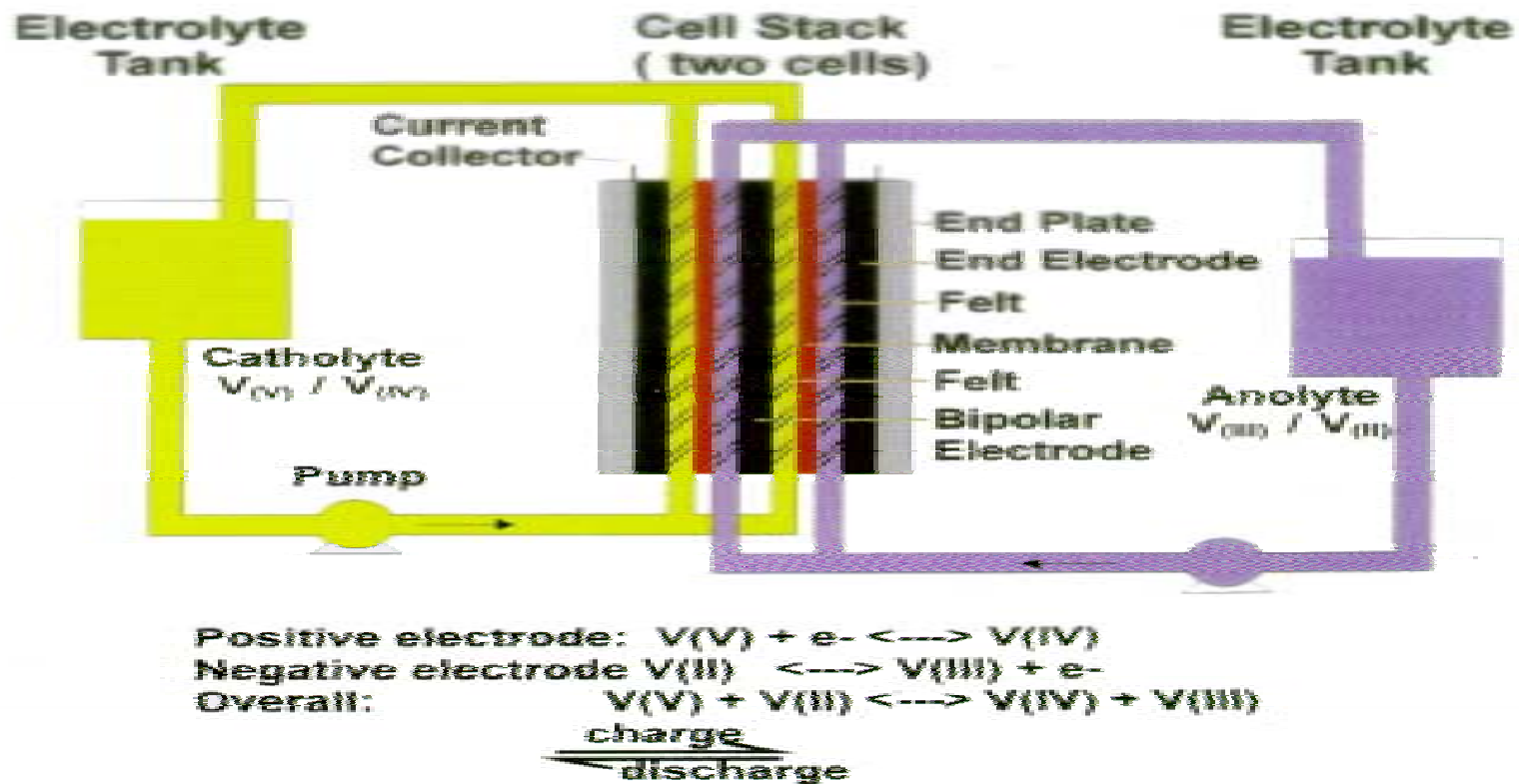
## PINNACLE VRB LTD

- **Company** - Australian Stock Exchange (PCE)
- **Assets** - VRB Technology
  - patents and IP acquired from UNSW 1998
- **Mission** - to commercialize Vanadium Energy Storage Systems (VESS)
- **Licensees** - SEI, Mitsubishi/Kashima Kita

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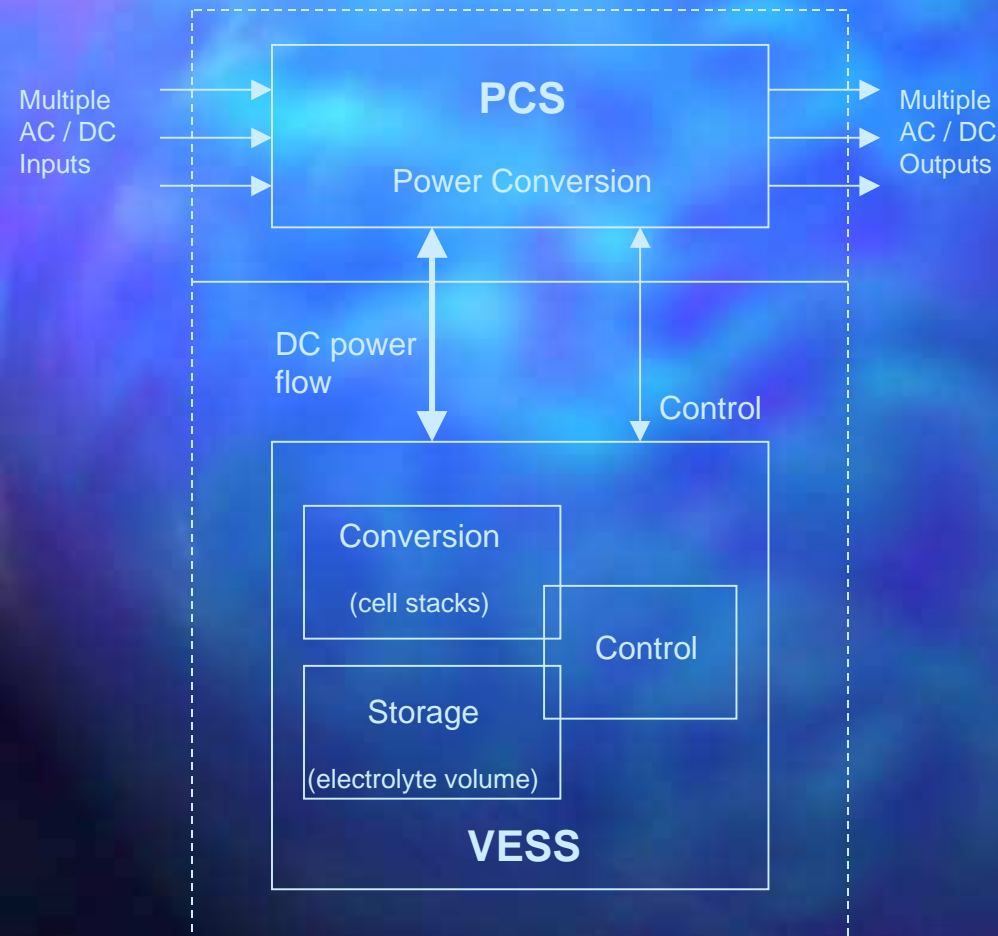
- Schematic of rechargeable vanadium fuel cell (ReVcell)





# VANADIUM ENERGY STORAGE SYSTEMS (VESS)

- **VESS - Schematic of VESS**



## VRB / VESS Incorporates

- Intelligent expert control technology
- VRB stacks and electrolytes

## VRB / VESS Provides

- Self capacity management
- Self maintenance and correction
- Status monitoring and reporting
- High cycle energy efficiency
- No life degradation from deep discharges
- Indefinite electrolyte life

## New Concept in Energy Storage

- Charge / discharge line voltage constraints removed
- Provides true energy and power transfer functions
- Decouples power and capacity functions
- Provides multiple input/output voltage capabilities
- Provides simultaneous charge/discharge capability
- All cells at same state of charge
- Power and capacity independently scalable



# APPLICATIONS OF VESS



- Mobile

- EV's, Fork Lifts, EGV
- Hybrids

- Stationary

- Grid Connected (supply side of meter)
- Non Grid Connected (customer side of meter)

# APPLICATIONS OF VESS



- **Grid Connected (supply side of meter)**
  - distributed resources including Renewables
  - power quality, UPS
  - load leveling, load shifting
  - deferral of generation/distribution assets
  - sub-sea DC links
  - mini-grids, (end of line capacity)
  - area frequency regulation/voltage control



# APPLICATIONS OF VESS

- Non grid connected (customer side of meter)
  - peak shaving, load shifting
  - power quality, UPS
  - electricity trading
  - RAPS & Renewables

# AUSTRALIAN RENEWABLE ENERGY PROGRAM



- Kyoto Protocols (108% of 1990 emissions 2008-2012)
- \$1 Billion in Government Support (GGAP)
- 2% Renewables by 2010
  - Increase of 9500 GWh/yr by 2000
  - Total Renewable 22,500GWh by 2000
  - 40 cents/kWh penalty (tradeable certificates)
  - RECP grants





# PINNACLE VRB's RENEWABLE ENERGY PROJECTS

## 1. Residential / Commercial RAPS

- 20 kW / 120 kWh VESS
- hostel / lodge State owned ecological/park island
- wind / solar / diesel power
- reduce diesel consumption

# PINNACLE VRB'S RENEWABLE ENERGY PROJECTS



## 2. Island Mini - grid RAPS

- 300kW / 1800 kWh VESS
- remote island 2.5 MW mini grid with diesels
- State power authority (HEC)
- Wind / pumped hydro / VESS
- Maximize diesel abatement

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## King Island SCHEMATIC OF PROPOSED RENEWABLE GENERATION

